IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	**:**	**09/471,659**
Appellant	**:**	**CLARK, Lloyd, et al.**
Filing Date	**:**	**12/24/1999**
Confirmation No	**:**	**7775**
Art Unit	**:**	**2611**
Examiner	**:**	**ODOM, Curtis B.**
Docket No.	**:**	**59.0021**

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPELLANT'S BRIEF ON APPEAL

1. Real Party in Interest

The real party in interest in this appeal is Schlumberger Technology Corporation, a corporation of Texas.

2. Related Appeals and Interferences

There are no related appeals and interferences.

3. Status of Claims

Claims 1, 10-11, 15, 18, 19, and 27 have been cancelled earlier in the prosecution of this patent application. Claims 2-9, 12-14, 16, 17, 20-26, and 28-53 are pending in the application. Claims 2-9, 12-14, 16, 17, 20-26, and 28-53 stand rejected the Office Action of 12/29/2006.

4. Status of Amendments

No amendments have been made since the Office Action of 12/29/2006. All amendments have been entered.

5. Summary of Invention

8. A telemetry system for transmitting well-logging data from at least one downhole tool (Fig.1, 16) to a surface data acquisition system (Fig. 1, 18), the at least one down hole tool having a first tool data input/output interface, the telemetry system comprising:

a. a downhole telemetry cartridge (Fig. 1, 10; Fig. 3, 10; Specification, Page 8, Line 10-Page 11, Line 13) connected to the at least one downhole tool (Fig. 1, 16) via a second tool data input/output interface (Fig. 3, 300) connected to the first tool data input/output interface, wherein the downhole telemetry cartridge (Fig. 1, 10; Fig. 3, 10) receives a bitstream from the at least one downhole tool (Fig. 1, 8) over the second input/output interface (Fig. 3, 300) and comprising:

a transmitter (Fig. 3, 307; Specification, Page 11, Lines 18-21) connected to the second tool data input/output interface (Fig. 3, 300), and having a logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies to an uphole telemetry unit (Fig. 1, 12; Fig. 4, 12; Specification, Page 11, Line 14 – Page 14, Line 6) connected to the downhole telemetry cartridge by a wireline (Fig.1, 14); and

a cable driver (Fig. 3, 310; Specification, Page 8, Line 29; Specification, Page 10, lines 1-4) having transmission power level control circuitry having logic to control the transmission power to optimize the total transmission power applied to the wireline cable in response to a received adjustment signal transmitted to the downhole telemetry cartridge from the uphole telemetry unit and wherein the adjustment signal is a function of cable length, cable material, cable temperature, and cable geometry (Specification, Page 17, Lines 6-15);

b. wherein the uphole telemetry unit (Fig. 1, 12; Fig. 4, 12; Specification, Page 11, Line 14 – Page 14, Line 6) is further connected to the surface data acquisition system (Fig. 1, 18) via an acquisition computer interface (Fig. 4, 400) and comprising

a receiver (Fig. 4, 411; Specification, Page 13, Lines 2, Page 13, Line 11- Page 14, Line 6) connected to the surface data acquisition system and having logic (Fig. 4, 418, Specification, Page 20, Line 20 –

Page 24, Line 28) operable to receive the analog signals on the plurality of carrier frequencies, to demodulate the received signals into a bitstream, and to output the bitstream to the acquisition computer via the acquisition computer interface (Fig. 4, 400);

overall power setting logic to measure the received signal amplitude (Fig. 6, 602) and, in response to the measure of the received signal amplitude, to transmit the adjustment signal to the downhole telemetry cartridge (Fig. 6, 604); and

logic to cause the overall power setting logic to be executed prior to determining bits-per-carrier (Fig. 6, 620) and power-level per carrier (Fig. 6, 614); and

c. a wireline cable (Fig. 1, 14) providing an electrical connection between the downhole telemetry cartridge (Fig. 1, 10; Fig. 3, 10) and the uphole telemetry unit (Fig. 1, 12; Fig. 4, 12), wherein the analog signals are transmitted in an uphole direction on the wireline cable.

9. A telemetry system for transmitting well-logging data from at least one downhole tool (Fig.1, 16) to a surface data acquisition system (Fig. 1, 18), the at least one down hole tool having a first tool data input/output interface, the telemetry system comprising:

a. a downhole telemetry cartridge (Fig. 1, 10; Fig. 3, 10; Specification, Page 8, Line 10-Page 11, Line 13) connected to an uphole telemetry unit (Fig. 1, 12; Fig. 4, 12; Specification, Page 11, Line 14 – Page 14, Line 6) over a wireline cable (Fig. 1, 14) that provides an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit;

b. the downhole telemetry cartridge connected to the at least one downhole tool via a second tool data input/output interface (Fig. 3, 300) connected to the first tool data input/output interface, wherein the downhole telemetry cartridge receives a bitstream from the at least one downhole tool over the second input/output interface and comprising:

a transmitter (Fig. 3, 305) connected to the second tool data input/output interface (Fig. 3, 300), and having a logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies and having logic to perform a training sequence including transmitting a known signal on the plurality of carriers, to receive a control signal, and in response to the control signal, to adjust at least one characteristic selected from the set having the members total power, power-per-carrier and bits-per-carrier (Fig. 3, 305; Specification, Page 14, Line 6-Page 20, Line 19); and

c. the uphole telemetry unit (Fig. 1, 12; Fig. 4, 12; Specification, Page 11, Line 14 – Page 14, Line 6) connected to the surface data acquisition system (Fig. 1, 18) via an acquisition computer interface (Fig. 4, 400) and comprising

a receiver (Fig. 4, 411; Specification, Page 13, Lines 2, Page 13, Line 11-Page 14, Line 6) connected to the surface data acquisition system (Fig. 1, 18) and having logic (Fig. 4, 418, Specification, Page 20, Line 20 – Page 24, Line 28) operable to receive the analog signals on the plurality of carrier frequencies, to demodulate the received signals into a bitstream, and to output the bitstream to the acquisition computer via the acquisition computer interface; and

an uphole transmitter (Fig. 4, 401; Specification, Page 11, Lines 16-21) operable to perform a training sequence (Figure 6; Specification, Page 16, Line 10 – Page 18, Line 18) including to receive the known signal (Fig. 6, 600, and in response to receiving the known signal, determining an adjustment selected from the set having the members total power (Fig. 6, 604), power-per-carrier (Fig. 6, 614) and bits-per-carrier (Fig. 6, 612), and to transmit control signals from the data acquisition system to the at least one downhole tool (Fig. 6, 604, 616), wherein the control signals are transmitted simultaneously on the wireline cable in a second propagation mode that is different from the first propagation mode and at least one of

the first and second propagation modes further comprises a pilot tone (Specification, Page 25, Lines 7-9);

wherein the performance of the training sequence is performed repeatedly during the course of a logging job (Specification, Page 18, Lines 6-7).

12. A telemetry system for transmitting well-logging data from at least one downhole tool (Fig.1, 16) to a surface data acquisition system (Fig. 1, 18), the at least one down hole tool having a first tool data input/output interface, the telemetry system comprising:

a. a downhole telemetry cartridge (Fig. 1, 10; Fig. 3, 10; Specification, Page 8, Line 10-Page 11, Line 13) connected to the at least one downhole tool (Fig. 1, 16) via a second tool data input/output interface (Fig. 3, 300) connected to the first tool data input/output interface, wherein the downhole telemetry cartridge receives a bitstream from the at least one downhole tool over the second input/output interface and comprising:

a transmitter (Fig. 3, 307; Specification, Page 11, Lines 18-21) connected to the second tool data input/output interface, and having a logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies;

a cable driver (Fig. 3, 310; Specification, Page 8, Line 29; Specification, Page 10, lines 1-4) having transmission power control circuitry having logic to independently control the transmission power of

each carrier frequency (Fig. 6, 618; Fig. 5, 512; Specification, Page 16, Lines 5-9); and

a logic to perform a training sequence (Fig. 6) including transmitting a known signal on the plurality of carriers (Fig. 6, 608), to receive a control signal (Fig. 6, 616), and in response to the control signal, to adjust the power-per-carrier (Fig. 6, 618; Specification, Page 17, Lines 29-31; Specification, Page 18, Lines 11-12);

b. an uphole telemetry unit (Fig. 1, 12; Fig. 4, 12; Specification, Page 11, Line 14 – Page 14, Line 6) connected to the surface data acquisition system (Fig. 1, 18) via an acquisition computer interface (Fig. 4, 400) and comprising

a receiver (Fig. 4, 411; Specification, Page 13, Lines 2, Page 13, Line 11-Page 14, Line 6) connected to the surface data acquisition system and having logic (Fig. 4, 418, Specification, Page 20, Line 20 – Page 24, Line 28) operable to receive the analog signals on the plurality of carrier frequencies, to demodulate the received signals into a bitstream, and to output the bitstream to the acquisition computer via the acquisition computer interface; and

to perform a training sequence (Fig. 6) including to receive the known signal (Fig. 6, 600, 608), and in response to receiving the known signal, determining an adjustment to the power-per-carrier (Fig. 6, 614); and

c. a wireline cable (Fig. 1, 14) providing an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit, wherein the analog signals are transmitted in an uphole direction on the wireline cable;

wherein the receiver further comprises logic operable to cause the transmission from the receiver to cable driver of a control signal indicative to the power level control circuitry to increase or decrease the transmission power for any carrier frequency (Fig. 6, 616; Specification, Page 18, Lines 11-12); and

wherein the training sequence is performed repeatedly during the course of a logging-job (Specification, Page 18, Lines 6-7).

13. A telemetry system for transmitting well-logging data from at least one downhole tool (Fig.1, 16) to a surface data acquisition system (Fig. 1, 18), the at least one down hole tool having a first tool data input/output interface, the telemetry system comprising:

a. a downhole telemetry cartridge (Fig. 1, 10; Fig. 3, 10; Specification, Page 8, Line 10-Page 11, Line 13) connected to the at least one downhole tool via a second tool data input/output interface connected to the first tool data input/output interface, wherein the downhole telemetry cartridge receives a bitstream from the at least one downhole tool over the second input/output interface and comprising:

a transmitter connected to the second tool data input/output interface, and having a logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies; and

a cable driver connected having transmission power level control circuitry having logic to control the total transmission power applied to the wireline cable;

b. an uphole telemetry unit connected to the surface data acquisition system via an acquisition computer interface and comprising

a receiver connected to the surface data acquisition system and having logic operable to receive the analog signals on the plurality of carrier frequencies, to demodulate the received signals into a bitstream, and to output the bitstream to the acquisition computer via the acquisition computer interface; and

c. a wireline cable providing an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit, wherein the analog signals are transmitted in an uphole direction on the wireline cable;

wherein the receiver further comprises logic operable to cause the transmission from the receiver to cable driver of a control signal indicative to the transmission power level control circuitry to increase or decrease the total transmission power applied to the wireline cable (Fig. 6, 604; Specification, Page 17, Lines 8-10).

14. A telemetry system for transmitting well-logging data from at least one downhole tool to a surface data acquisition system, the at least one down hole tool having a first tool data input/output interface, the telemetry system comprising:

a. a downhole telemetry cartridge (Fig. 1, 10; Fig. 3, 10; Specification, Page 8, Line 10-Page 11, Line 13) connected to the at least one downhole tool via a second tool data input/output interface connected to the first tool data input/output interface, wherein the downhole telemetry cartridge receives a bitstream from the at least one downhole tool over the second input/output interface and comprising:

    a transmitter connected to the second tool data input/output interface, and having a logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies;

b. an uphole telemetry unit (Fig. 1, 12; Fig. 4, 12; Specification, Page 11, Line 14 – Page 14, Line 6) connected to the surface data acquisition system via an acquisition computer interface and comprising

    a receiver connected to the surface data acquisition system and having logic operable to receive the analog signals on the plurality of carrier frequencies, to demodulate the received signals into a bitstream, and to output the bitstream to the acquisition computer via the acquisition computer interface; and

c. a wireline cable (Fig. 1, 14) providing an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit, wherein the analog signals are transmitted in an uphole direction on the wireline cable;

d. a tone ordering logic (Fig. 5a, 506) operable to divide the bit stream into bit groups such that there is a one-to-one mapping between bit groups and carrier frequencies;

e. a downhole bits-per-carrier table (Fig. 5a, 508) containing a mapping between each bit group and the number of bits allocated to each carrier for each cycle of operation;

f. a constellation encoder (Fig. 5, 510) connected to receive the bit groups from the tone ordering logic and the bits-per-carrier from the bits-per-carrier table, and operable to encode the bit groups as complex numbers; and

g. a training logic (Fig. 5, 516) executed repeatedly during the course of a logging job and operable to populate the bits-per-carrier table (Specification, Page 18, Lines 6-7).

21. A method of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, comprising:

executing a training sequence having the steps of:

transmitting a known signal on each of a plurality of carriers from the downhole telemetry cartridge to the uphole telemetry unit (Fig. 6, 600, 608);

measuring at the uphole telemetry unit the signal-to-noise ratio on the known signal on each of the plurality of carriers (Fig. 6, 610);

using the signal-to-noise ratio measurement to determine the number of bits-per-constellation to use for each carrier (Fig. 6, 612); and

populating a bits-per-carrier table with the bits-per-constellation value for each carrier (Fig. 6, 618, 620); and

dynamically (Specification, Page 18, Lines 6-7) adjusting (Fig. 6, 618, 620) the bits-per-carrier table (Fig. 5a, 508) during the course of a logging job by re-transmitting the known signal on a subset of the plurality of carriers, re-measuring at the uphole telemetry unit the signal-to-noise ratio on each of the subset of plurality of carriers, using the re-measured signal-to-noise ratio on each of the subset of plurality of carrier to determine the number of bits-per-constellation to use for each of the subset of the plurality of carriers; and populating the bits-per-carrier table entries for each of the subset of the plurality of carriers with the bits-per-constellation value for each of the subset of the plurality of carriers.

26. A method of operating a well-logging telemetry system having a downhole telemetry cartridge (Fig. 1, 10; Fig. 3, 10; Specification, Page 8, Line 10-Page 11, Line 13) and an uphole telemetry unit (Fig. 1, 12; Fig. 4, 12; Specification, Page 11, Line 14 – Page 14, Line 6) connected by a wireline cable, comprising:

during the course of a logging job, repeatedly performing a training sequence (Specification, Page 18, Lines 6-7) including:

transmitting a signal of known power level on each of a plurality of carriers from the downhole telemetry cartridge to the uphole telemetry unit (Fig. 6, 600);

measuring the signal amplitude received on each carrier (Fig. 6, 602);

comparing the power level received on each carrier to a predetermined maximum power level for each carrier (Specification, Page 16, Lines 23-24);

based on the comparison of power level, transmitting an indication to adjust the power level on at least one of the carriers from the uphole telemetry unit to the downhole telemetry cartridge (Fig. 6, 616);

adjusting the power level of at least one of the carriers based on the indication received (Fig. 6, 618).

28. A method of operating a well-logging telemetry system having a downhole telemetry cartridge (Fig. 1, 10; Fig. 3, 10; Specification, Page 8, Line 10-Page 11, Line 13) and an uphole telemetry unit (Fig. 1, 12; Fig. 4, 12; Specification, Page 11, Line 14 – Page 14, Line 6) connected by a wireline cable, comprising:

modulating a bit stream onto a plurality of carrier frequencies (Fig. 5);

transmitting the modulated bit stream on a first propagation mode from the downhole telemetry cartridge to the uphole telemetry unit (Specification, Page 20, Lines 16-19; Specification, Page 25, Lines 5-7);

operating the uphole telemetry unit to demodulate the received bitstream (Fig. 7);

during the course of a logging job, repeatedly:

using a training sequence to populate a bits-per-carrier table in the downhole telemetry cartridge and a bits-per-carrier table in the uphole telemetry unit (Fig. 6);

wherein the step of modulating the bit stream onto a plurality of carrier frequencies modulates the bit stream for each carrier according to values stored in the downhole bits-per-carrier table for such each carrier (Fig. 5A, 508); and

wherein the step of demodulating the bit stream demodulates the bit stream from each carrier according to values stored in the uphole bits-per-carrier table (Fig. 7C, 727).

29. A method of operating a well-logging telemetry system having a downhole telemetry cartridge (Fig. 1, 10; Fig. 3, 10; Specification, Page 8, Line 10-Page 11, Line 13) and an uphole telemetry unit (Fig. 1, 12; Fig. 4, 12; Specification, Page 11, Line 14 – Page 14, Line 6) connected by a wireline cable (Fig. 1, 14), comprising:

modulating a bit stream onto a plurality of carrier frequencies (Fig. 5);

transmitting the modulated bit stream on a first propagation mode from the downhole telemetry cartridge to the uphole telemetry unit (Specification, Page 20, Lines 16-19; Specification, Page 25, Lines 5-7);

operating the uphole telemetry unit to demodulate the received bitstream (Fig. 7);

during the course of a logging job, repeatedly:

using a training sequence to populate a downhole gain table (Fig. 5A, 514) in the downhole telemetry cartridge and an uphole gain table (Fig. 7C,723) in the uphole telemetry unit; and

adjusting the gain on each carrier based on values stored in the downhole gain table (Fig. 5, 512).

The invention is directed to the application of Discrete Multitone (DMT) modulation to oil field well-logging wireline telemetry systems. The invention proposes several techniques designed to make DMT operable in the harsh environment of oil wells. The techniques include, for example, a power setting logic to set the overall power-level prior to determining bits-per-carrier and power-level per carrier (Claims 8); performing a training sequence to adjust total transmission power, power-per-carrier, and bits-per-carrier, repeatedly during the course of a logging job (Claim 9), determining an adjustment to the power-per-carrier based on the reception of a known signal (Claim 12), transmitting a control signal from the surface equipment to the downhole equipment to increase or decrease the total transmission power applied to the wireline cable (Claim 13), techniques for populating a bits-per-carrier table based on a training logic executed repeatedly during the course of a logging job (Claim 14 and 21), comparing the power level received on each carrier to a predetermined maximum and adjusting the power level based on the indication received (Claim 26), during the course of a logging job, repeatedly using a training sequence to populate a bits-per-carrier table in the downhole telemetry cartridge and a bits-per-carrier table in the uphole telemetry unit (Claim 28), and during the course of a logging job, repeatedly using a training sequence to populate a downhole gain table in the downhole telemetry cartridge and an uphole gain table in the uphole telemetry unit; and adjusting the gain on each carrier based on values stored in the downhole gain table (Claim 29).

6. Grounds for Rejection to be Reviewed on Appeal

1. 35 USC 103(a)

Claims 8, 13, 20, and 30 have been rejected under 35 USC 103(a) as being unpatentable over U.S. Pat. 5,365,229 to Gardner et al (cited by the Examiner as "Gardener (sic) et al (previously cited in Office Action 9/8/03)"; "*Gardner*") in view of U.S. Pat. 6,493,395 to Isaksson et al. (cited by the Examiner as "previously cited in Office Action 3/19/2004"; "*Isaksson*"), and U.S. Patent 6,647,058 to Bremer et al. ("*Bremer*").

2. 35 USC 103(a)

Claims 2-7, 9 and 42-44 have been rejected under 35 USC 103(a) as being unpatentable over *Gardner* in view of U.S. Pat. 6,473,438 to Cioffi et al. (cited by the Examiner as "previously cited in Office Action 5/13/2006") and further in view of U.S. Patent 6,469,636 to Baird et al. (Cited by the Examiner as "previously cited in Office Action 9/8/03"; "*Baird*").

3. 35 USC 103(a)

Claim 12 has been rejected under 35 USC 103(a) as being unpatentable over *Gardner* in view of *Cioffi* and further in view of *Isaksson*.

4. 35 USC 103(a)

Claims 14, 16, 17, 21-25, 28, 29, 31-35, 37-41, 48, 51-53 have been rejected under 35 USC 103(a) as being unpatentable over *Gardner* in view of U.S. Pat. 6,522,731

to Matsumoto (cited by the Examiner as "previously cited in Office Action 1/26/2005; "*Matsumoto*") and further in view of *Cioffi*.

5. 35 USC 103(a)

Claims 26, 45-47, 49, and 50 have been rejected under 35 USC 103(a) as being unpatentable over *Gardner* in view of U.S. Pat. 5,832,387 to Bae (cited by the Examiner as "previously cited in Office Action 5/13/2006; "*Bae*") and further in view of *Cioffi*.

6. 35 USC 103(a)

Claim 36 has been rejected under 35 USC 103(a) as being unpatentable over *Gardner* in view of *Bae* and further in view of *Cioffi*, further in view of U.S. Patent 5,812,599 to *Van Kerckhove* (Cited by the Examiner as "*Van Kerchove* (sic) (previously cited in Office Action 9/12/2005)"; "*Van Kerckhove*").

7. Argument

7.1 Overview

In formulating the rejection of the claims of the present patent application the Examiner relies on combinations of two categories of references, namely, ones from the art of discrete multitone (DMT) modulation (*Bae, Bremer, Cioffi*, *Isaksson*, *Matsumoto*, and *Van Kerckhove*) with references from the field of oil field well-logging telemetry (*Baird*, *Gardner*). In each rejection at least three references are relied on; and in the majority of rejections at least two distinct DMT references are used.

The issue of the present appeal may succinctly be summarized as to whether it would be obvious to a person skilled in the art to combine an oil field well-logging

telemetry reference (*Gardner)* with a DMT reference *(*either *Cioffi* or *Isaksson*) and refine that combination with some special technique found in the third reference (*Bremer, Baird, Matsumoto, Bae,* or *Van Kerckhove*).

7.2 Principles of Law

"Section 103 forbids the issuance of a patent on an application when 'the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.'" *KSR Int'l Co. v. Teleflex Inc*., 127 S.Ct. 1727, 1734, 82 USPQ2d 1385, 1391 (2007) (*cited in, Ex Parte Carolyn Ramsey Catan*, No. 2007-0820, ___ USPQ2d _____ (B.P.A.I. 2007); *see also Graham v. John Deere Co.,* 383 U.S. 1, 14, 86 S. Ct. 684, 15 L. Ed. 2d 545 (1966); *In re Dembiczak,* 175 F.3d 994, 998 (Fed. Cir. 1999).

In *Graham* "the Court set out a framework for applying the statutory language of § 103." *KSR* at 1734, 82 USPQ2d at 1391. "The analysis is objective:

> 'Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or non-obviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances

surrounding the origin of the subject matter sought to be patented.'" *KSR* at 1734, 82 USPQ25 at 1391, *quoting Graham* at 17-18, 86 S. Ct. 684, 15 L. Ed. 2d 545.

"Seeking to resolve the question of obviousness with more uniformity and consistency, the Court of Appeals for the Federal Circuit has employed an approach referred to by the parties as the "teaching, suggestion, or motivation" test (TSM test), under which a patent claim is only proved obvious if "some motivation or suggestion to combine the prior art teachings" can be found in the prior art, the nature of the problem, or the knowledge of a person having ordinary skill in the art. See, *e.g., Al-Site Corp.* v. *VSI Int'l, Inc.*, 174 F.3d 1308, 1323-1324 (CA Fed. 1999)" *KSR* at 1734, 82 USPQ2d.

While the Court reversed the Court of Appeals for the Federal Circuit because the latter's rigid application of the TSM test, the Court stated that "[t]here is no necessary inconsistency between the idea underlying the TSM test and the *Graham* analysis. But when a court transforms the general principle into a rigid rule that limits the obviousness inquiry, as the Court of Appeals did here, it errs." *KSR* at 1741. The Court also stated that:

> "Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. This is so because inventions in most, if not all, instances rely upon building blocks long

since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known." *KSR* at 1741.

In the particular case of *KSR*, and followed by the Board of Patent Appeals and Interferences in *Catan*, the Court noted that "[i]f a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *KSR* at 1740 (*emphasis added*).

As noted in *Catan* "[the] Supreme Court made clear that '[f]ollowing these principles may be more difficult in other cases than it is here because the claimed subject matter may involve more than the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement.'" *Catan* at 10, *quoting KSR* at 1740, 82 USPQ2d at 1396. "'Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue… [T]o facilitate review, this analysis should be made explicit.'" *Catan* at 10, quoting *KSR* at 1740, citing *In re Kahn*, 441 F.3d 977, 988 (CA Fed. 2006).

It should be noted the simplicity of the *KSR* innovation. The patent at issue in *KSR* "[claims] a position-adjustable pedal assembly with an electronic pedal position sensor attached a fixed pivot point." A first prior art reference, *Asano*, teaches an adjustable pedal with a fixed pivot point. A second reference, *Smith*, discloses that a sensor is favorably located at a fixed pivot point. Thus, to arrive at the invention, a mere trivial addition of the disclosure of *Smith* to the disclosure of *Asano* yields the invention. Such a simple addition would be within the skills of a person of ordinary skill in the art.

The teaching, suggestion, or motivation to combine references "may be implicit from the prior art as a whole … The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." *In re Kotzab*, 217 F.3d 1365, 1370 (Fed. Cir. 2000). In *KSR* the Court explained that "any need or problem known in the field of endeavor at the time of the invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *KSR* at 1742.

<u>7.3 The References</u>

As noted hereinabove, there are references from two areas of endeavor, oil field well-logging wireline telemetry and telephony/DSL based DMT.

<u>7.3.1 The Oil field References</u>

<u>*Gardner*</u>

Gardner teaches a prior art well-logging telemetry system for use on wireline logging systems. *Gardner* describes "a wireline telemetry system that uses multilevel correlative coding to provide high data rates and adaptive equalization to deal with the variation in channel distortion" (Col. 2, line 1-4). *Gardner* recognizes that the hostile environment for logging tools places severe demands on the wireline telemetry because of the variations in logging cable characteristics (*Gardner*, Abstract). Uplink data signal, the downlink data signal and the tool power are frequency multiplexed on the cable to avoid interference (*Gardner*, Col. 3. lines 7-9). *Gardner* teaches a telemetry system in which data is transmitted on a single-carrier.

<u>*Baird*</u>

Baird like *Gardner* is an example of the traditional well-logging systems. In particular, *Baird* describes a logging cable for providing large amounts of power downhole to a well-logging tool and for transmitting signals between the surface and the instruments in the well-logging tool. Baird observes that logging cables are typically five or more miles (26 400 feet) in length and are subject to strong capacitive and inductive coupling. (*Baird*, Col. 5, ll. 1-3). Baird describes a system based on a seven conductor logging cable. (*Baird*, Col. 5, ll. 39-41). Baird teaches the use of eigenmodes for transmission over groupings of conductors in a multi-conductor cable to avoid crosstalk. (*Baird*, Col. 5, ll. 6-12).

The Examiner uses *Baird* for the notion of controlling power sources such as drivers to maximize the power capacity of well-logging cable and having different propagation modes for simultaneously transmitting a control signal such as a pilot signal.

7.3.2. The Telephony/DSL References

Isaksson

Isaksson describes a DMT system as implemented in a multi-carrier system for the installed copper network ("MUSIC is intended to provide high-speed communication on telephone copper wire pairs for supporting broadband multimedia services", *Isaksson*, Col. 6, lines 23-24). This system provides transmission over copper cables up to a length of 1300 meters (*Isaksson*, Col. 6, Lines 33-34).

Cioffi

Cioffi describes techniques used to provide DMT data transmission over a medium shared by a plurality of remote units, e.g., over "cable systems and wireless cellular television delivery since these systems use a single line (medium) to service a relatively large number of independent remote units." (*Cioffi*, Col. 7, ll. 10-21). *Cioffi* describes a DMT system using the ADSL standard.

The Examiner uses *Cioffi* for its alleged teaching of DMT and teaching of use of training signals coupled with period retraining.

Matsumoto

Matsumoto deals with solving problems that one may encounter in the telephony art. In particular, *Matsumoto* deals with problems that are associated with using a telephone line simultaneously for data communication and audio communication “”An on-hook/off-hook detection circuit detects the voltage level of a telephone line ad thus detects whether the audio band communication using the telephone C is in on-hook state or in off-hook state thereby to output a status detection signal (81). (*Matsumoto,* Abstract).

The Examiner uses *Matsumoto* for its alleged teaching of DMT modulation having a mechanism to assign bit groups to carrier frequencies, and allocation of number of bits per carrier, and a constellation encoder to encode bit groups as a constellation (complex number).

Bae

Bae describes an adaptive power allocation apparatus for a multi-tone modulation system, in which Signal-to-Noise (SNR) for each subchannel is used to set and control a power level for that subchannel.

The Examiner uses *Bae* for its alleged teaching of using SNR for each subchannel to adjust the power level for that subchannel.

Van Kerckhove

Van Kerckhove presents a method for allocating bits of data elements in a DMT system, e.g., an ADSL (Asymmetric Digital Subscriber Line) system. The *Van Kerckhove* system first allocates bits according to a full-capacity step in which the bits are allocated to individual carriers as a function of the observed SNR for such individual carrier. Next, if necessary, a fine-tuning step is performed. If the initial allocation is insufficient for the data to be transmitted, an overall power boost designed to increase the SNR is calculated and applied. Subsequent to the improvement in SNR, the additional bit or bits are allocated over the carriers.

The Examiner relies on *Van Kerckhove* for the concept of determining whether an increase in power level would improve the bits-per-carrier for each carrier or whether a decrease in power level would degrade the bits-per-carrier for each carrier. *Van Kerckhove* teaches a determination of whether a decrease in power level would degrade the bits-per-carrier. On such condition, *Van Kerckhove* teaches the removal of bits from selected carriers if there is an over-allocation. While adjustment of power level is mentioned, *Van Kerckhove* teaches that in their implementation the improved noise margin is gained rather than decreasing power.

Bremer

Bremer teaches a system and process for customizing the performance of an xDSL system in which transmitting and receiving modems negotiate a performance parameter for adjustment.

The Examiner relies on *Bremer* for the concept of optimizing transmission power on a DSL cable by measuring SNR and using the measured SNR to adjust power level.

Summary of the Rejections

The following chart illustrates the manner in which the Examiner has applied these various references to the claims:

Office Action Paragraph		4	5	6	7	8	9
		8,13, 20,30	2-7,9, 42-44	12	14,16,17,21-25,28,29,31-35,37-41,48,51-53	26,45-47,49, 50	36
Telephony/DSL							
Isaksson	6,493,395	x		x			
Cioffi	6,473,438		x	x	x	x	x
Matsumoto	6,522,731				x		
Bae	5,832,387					x	x
Van Kerckhove	5,812,599						x
Bremer		x					
Oil Field							
Gardner	5,365,229	x		x	x x	x	x
Baird	6,469,636			x			

Thus, each of these rejections require the combination of *Gardner*, which teaches a traditional single-carrier oil field well-logging wireline telemetry solution, with a telephony/DSL based DMT solution, and some other refinement (either from the oil field telemetry art, *Baird*, or from the telephony/DSL art (*Bremer, Matsumoto, Bae,* or *Van Kerckhove*).

In each of these rejections the Examiner has argued that all the elements may be found in a combination of elements selected form the various cited references. However, the mere identification of elements from various prior art references that may somehow be assembled into the claimed invention is not sufficient to negate patentablility. As noted in *KSR* at 1740, "inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known." *KSR* at 1740.

While "the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results" (*KSR* at 1739), such is not the case here. As discussed in the Declaration of Michael Montgomery (Filed with the Response to Office Action on December 12, 2005), the harsh conditions of well-logging operations present many challenges to communications used therein. (Declaration of Michael Montgomery, pp. 2-4). Mr. Montgomery further observes that "[t]he art cited provides no clue as to whether the components or design techniques would even work in the hostile borehole environment, or with a radically changing communications channel, or what techniques might be required to adapt to such a hostile environment." (Declaration of Michael Montgomery, page 4).

Dr. Lloyd Clark, in his declaration, describes the difficulty in finding DSL equipment that would operate at the specified criteria for well-logging operations, e.g., cable lengths of 30,000 feet and the mechanical requirements of the logging cable. (Declaration of Dr. Lloyd D. Clark submitted with Response to Office Action on

December 12, 2005, pp. 2 – 3). As Dr. Clark further observes, a person of ordinary skill in the art would not expect success from applying known DMT techniques in wireline telemetry systems for well-logging. (Declaration of Dr. Clark, page 3).

Both DSL references, *Isaksson* and *Cioffi*, relate techniques using the ADSL standard. Both have limitations unsuitable to the well-logging wireline telemetry environment. *Isaksson*, for example, describes that "the cable length specification for MUSIC can be successfully limited to 1300 meters", i.e., a cable length much too short to be of interest in the well-logging application. While *Cioffi* describes that the techniques taught therein are applicable to a variety of communications media, *Cioffi* does not suggest that the techniques taught therein can be used to overcome the difficulties in applying DMT to the oil field well-logging wireline telemetry.

Turning now to the specific rejections set forth in Office Action.

Combination of *Gardner and Isaksson* - Rejection of Claims 8, 13, 20, and 30

The Examiner rejected Claims 8, 13, 20, and 30 as unpatentable over *Gardner* in view of *Isaksson*, and further in view of Bremer.

Gardner teaches a prior art well-logging telemetry system for use on wireline logging systems. *Gardner* describes "a wireline telemetry system that uses multilevel correlative coding to provide high data rates and adaptive equalization to deal with the variation in channel distortion" (Col. 2, line 1-4). *Gardner* recognizes that the hostile environment for logging tools places severe demands on the wireline telemetry because

of the variations in logging cable characteristics (*Gardner*, Abstract). Uplink data signal, the downlink data signal and the tool power are frequency multiplexed on the cable to avoid interference (*Gardner*, Col. 3. lines 7-9). *Gardner* teaches a telemetry system in which data is transmitted on a single-carrier. The Examiner has correctly observed that *Gardner* "does not disclose the apparatus having logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies and optimizing the total transmission power applied to the wireline in response to a received adjustment signal (Office Action, Page 4, Lines 1-4).

Isaksson describes a DMT system as implemented in a multi-carrier system for the installed copper network ("MUSIC is intended to provide high-speed communication on telephone copper wire pairs for supporting broadband multimedia services", *Isaksson*, Col. 6, lines 23-24). This system provides transmission over copper cables up to a length of 1300 meters (*Isaksson*, Col. 6, Lines 33-34).

Given the various inherent difficulties of operating communications equipment in a borehole and the highly dynamic nature of the communications channel in a well-logging wireline application, and the limitations described in *Isaksson,* it cannot be said that applying *Isaksson* to *Gardner* would yield a predictable result. Furthermore, the making such a system work would require much more than just plugging *Isaksson* into *Gardner* in the manner that the innovation in *KSR* was merely the placement of a sensor at a location taught by a second reference.

Rather, to make DMT work in an oil field well-logging wireline application requires a great deal of engineering effort. Thus, since the application of *Isaksson* to *Gardner* is not predictable and the application of *Isaksson* is well beyond the skill of a person of ordinary skill in the art, Claims 8, 13, 20 and 30 should not be rejected over the combination of *Gardner* and *Isaksson*.

Motivation to combine Gardner and Isaksson. "The motivation, suggestion or teaching [of the proposed combination] may come explicitly form statements in the prior art, the knowledge of one of ordinary skill in the art, or in some cases the nature to be solved." *In re Kotzab,* at 1370. In the present case there is no teaching or suggestion in either *Gardner* nor in *Isaksson* to combine the teachings of the one with the other. The Examiner has argued that the motivation to combine is that "since *Isaksson* et al. states DMT modulation handles frequency dependent loss and noise in cables in an efficient manner and also provides high bit rate traffic over the cables (column 1, lines 14-23 and column 7, lines 5-20)" (Office Action, Page 4, Lines 17-19).

The guidance of *KSR,* that with respect to inventions that "involve more that the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement", has not been met by the Examiner. *KSR* states that in such cases "it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an

apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit." *KSR* at 1740. It is implicit that the reasoning also should make good logical sense.

That is not the case here. The motivation that *Isaksson* states that DMT modulation handles frequency dependent loss and noise in cable in an efficient manner and also provides high bit rate traffic over cables is neither an express or implicit suggestion to use *Isaksson*'s DMT system for the installed copper network in an oil well well-logging apparatus such as taught by *Gardner*.

There is nothing to indicate that person of ordinary skill in the art facing the problem of improving telemetry systems for well-logging, e.g., systems such as *Gardner*, would realize a need for "handling frequency dependent loss and noise". *Gardner*'s telemetry systems were not confronted with frequency dependent loss and noise in that *Gardner* transmits in a single-carrier frequency. Thus, it is not logical that a person of ordinary skill in the art would be motivated to combine these references on the notion that *Isaksson* et al. states DMT modulation handles frequency dependent loss and noise in cables in an efficient manner and also provides high bit rate traffic over the cables because that was not a problem faced in *Gardner*.

An analysis of the Examiner's reasoning would reveal a sort of circular argument is being applied which presupposes the existence of a system that provides multi-carrier transmission in a well-logging wireline system. Because only then could the problems that the Examiner states as motivation to combine *Gardner* and *Isaksson* arise.

Accordingly, it is evident that a hindsight analysis has been employed not only in finding the elements of the claims in various references, but also in providing the motivation to combine these references.

Expectation of success.

"A proper analysis under § 103 requires … consideration of … whether the prior art would also have revealed that [in making the claimed device] those of ordinary skill in the art would have a reasonable expectation of success." *In re Vaeck*, 947 F.2d 488, 493 (Fed. Cir. 1991), *citing*, *Dow Chemical Co.,* 837 F.2d 469, 473, 5 U.S.P.Q.2D (BNA) 1529, 1531 (Fed. Cir. 1988). "Both the suggestion and the reasonable expectation of success must be founded in the prior art, not in the applicant's disclosure." *Id.* The evidence in the present case does not support a conclusion of reasonable expectation of success in combining *Gardner* and *Isaksson*.

Isaksson discusses that "MUSIC is intended to provide high-speed communication on telephone copper wire pairs for supporting broadband multimedia services." *Isaksson*, Col. 6, lines 20-24. As discussed in the Declarations of Dr. Lloyd Clark and Mr. Michael Montgomery filed in the parent case on December 12, 2005 a person of ordinary skill in the art would not expect success from applying known DMT techniques to wireline telemetry systems for well-logging. Declaration of Dr. Lloyd Clark, page 3, Declaration of Mr. Montgomery, pages 2-6. One reason for that lack of expectation of success is the length of the cables involved. There is no evidence that there would be a reasonable expectation of success for providing such service on oil field well-

logging cables. A typical wireline cable exceeds 30,000 feet. *Isaksson* explicitly states that, "the cable length specification for MUSIC can be successfully limited to 1300 meters. *Isaksson*, Col. 6, lines 33-34. There is nothing in *Isaksson* to suggest its applicability to longer cables. Another difficulty in applying DSL techniques to the wireline environment is the difficult operating conditions.

Initial experimentation by the inventors illustrated the difficulty in taking existing DSL equipment to the wireline cables. These experiments demonstrated that DMT-based ADSL modems could not establish a communications link when used over a 30,000-foot length of well-logging wireline cable. Lloyd Declaration, Page 3.

Thus, there is no reasonable expectation of success in applying the DSL techniques of *Isaksson* to the oil field well-logging telemetry system of *Gardner*.

Bremer

The rejection of Claims 8, 13, 20, and 30 further requires the combination of the *Gardner* and *Isaksson* references with *Bremer*. As noted above, application of DMT modulation to the well-logging wireline telemetry systems required a great deal of engineering effort. (*See, Declaration of Dr. Lloyd Clark*). One aspect of that engineering effort was the recognition that it would be beneficial to "overall power setting logic to measure the received signal amplitude and, in response to the measure of the received signal amplitude, to transmit the adjustment signal to the downhole telemetry cartridge; and logic to cause the overall power setting logic to be executed prior to determining bits-per-carrier and power-level per carrier" (Claim 8) and "the receiver further comprises

logic operable to cause the transmission from the receiver to cable driver of a control signal indicative to the transmission power level control circuitry to increase or decrease the total transmission power applied to the wireline cable" (Claim 13). This is not a standard DSL or DMT technique.

Therefore, the Examiner relied on *Bremer* to provide these elements. However, even in doing so, the Examiner has not set forth that *Bremer* teaches these elements from Claim 8 but rather states that, "*Bremer* et al. further discloses optimizing a transmission power applied to a cable (DSL) by measuring the SNR." (Office Action, Page 5, ll. 20-21). Measuring SNR and using it to adjust transmission power is part of other claims. However, Claims 8 recites "overall power setting logic to measure the received signal amplitude and, in response to the measure of the received signal amplitude, to transmit the adjustment signal to the downhole telemetry cartridge." This element is neither taught nor suggested by *Bremer*.

According to *KSR* "One of the ways in which a patent's subject matter can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims." (*KSR* at 1742). However, that there would be a problem in using DMT modulation in oil field well-logging wireline telemetry that would require this solution could not be known until attempts to use DMT modulation in wireline telemetry had been attempted and failed.

The Examiner's suggested motivation to combine *Bremer* with *Gardner* and *Isaksson* is nonsensical. The Examiner offers as motivation that, "*Bremer* et al. states the

transmission power control can optimize the transmission cable length used in the system. (Office Action, Page 6, ll. 10-11). Appellants request the Board to take judicial notice of that cable length is not an optimizable parameter in oil field well-logging. The cable length is what it is. Namely, designed to reach certain depths in a borehole where well-logging is desirable.

The Examiner has failed to provide a logical motivation to combine *Gardner*, *Isaksson* and *Gardner*, *Isaksson*, and Bremer. The offered motivations for these two combinations are akin to the universal desire to improve existing processes and is no more than the implicit motivation which always exists to make products stronger, cheaper, cleaner, faster, lighter, smaller, more durable, or more efficient. *Dystar v. Bann,* 2006 U.S. App. LEXIS 24642, *33 (Fed. Cir. 2006). True, when successfully deployed, DMT is faster and more efficient than the prior art oil field telemetry systems. However, in such situations, i.e., when the motivation to combine is merely these implicit motivations that drive the desire for technological progress, "the proper question is whether the ordinary artisan possesses knowledge and skills rendering him capable of combining the prior art references." (*Dystar*, at *33). Making DMT work in the oil field wireline well-logging environment was no small feat achieved by the inventors. Only through a great deal of effort and experimentation did the inventors achieve at the particular limitations that are claimed herein, for example, setting the overall power setting prior to determining bits-per-carrier and power-level per carrier (Claim 8 and similar in Claim 13). A person of ordinary skill in the art would not have had the

knowledge to combine teachings from Bremer with *Gardner* and *Isaksson* to include such an element.

Accordingly, the combination of *Gardner* with *Isaksson*, there is not a reasonable expectation for success, there is not a predictable result, and the problems that would arise if the combination were not a known problem with an obvious solution. Furthermore, there is a lack of motivation to combine *Bremer* with *Gardner* and *Isaksson*. And even if that combination were attempted, at least one element of Claim 8 would be missing from that combined teaching.

At least for any one of these reasons, Claims 8 and 13 are not obvious over the *Gardner*, *Isaksson*, and *Bremer*, taken singly or in combination.

Combination of Cioffi and Gardner

Claims 2-7, 9, and 42-44 are rejected as unpatentable over the combination of *Cioffi* , *Gardner* and *Baird*, Claims 14, 16, 17, 21-25,28,29,31-35,37-41, 48, 51-53 stand rejected as unpatentable over the combination of *Cioffi*, *Gardner* and Masumoto; Claims 26, 45-47,49,50 stand rejected over the combination of *Cioffi*, *Bae*, and *Gardner*; and Claim 36 stands rejected over the combination of *Cioffi*, *Bae*, *Van Kerckhove*, and *Gardner*. Thus, common to these rejections is the combination of *Cioffi* and *Gardner*. That combination will be dealt with in this section.

The legal analysis presented herein above in support of claim 8 as to the proposed combination of DSL art, e.g., *Isaksson*, with *Gardner* is incorporated here by reference.

The courts have pointed out that, "virtually all inventions are combinations of old elements." *In re Rouffet*, at 1357; *see also KSR* at 1741 ("inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known."). "If identification of each claimed element in the prior art were sufficient to negate patentability, very few patents would ever issue." "As is clear from cases such as *Adams*, a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *KSR* at 1741.

In support of the motivation to combine *Cioffi* and *Gardner* the Examiner makes the statement that "it would have been obvious to one skilled in the art to modify the system in *Gardner* with DMT modulation and training as taught by *Cioffi* "since *Cioffi* et al. states DMT modulation avoids various signal distortion and noise problems (column 1, lines 21-25)" (Office Action, Page 10, ll. 19-20). Applicants disagree. The actual statement from *Cioffi* is that "among the benefits of DMT architectures is that they have high spectral efficiencies and ***can adaptively*** avoid ***various*** signal distortion and noise problems." It is not clear what these various signal and noise problems are. Are these problems that occur on a dedicated single-carrier system such as traditionally deployed in a well-logging wireline telemetry system? Appellants posit that such could not be the case since *Cioffi* does not teach or suggest that it would be applied to single-carrier systems.

Virtually every patent will state some advantage that comes from the use of the invention described therein. It is hard for the Appellant to envision how any invention can be patentable if all the Examiner has to do is to point to some stated advantage in one of the references and conclude that from that advantage it would be obvious to modify another reference to incorporate the teachings of the former. "Rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988, 78 USPQ.2D 1329 (Fed. Cir. 2006), *cited by (KSR* at 1741).

The Examiner's suggested reason for the combination of *Gardner* and *Cioffi* presupposes that *Gardner* was faced with "signal distortion and noise problems". However, there is no evidence that such is the case. *Cioffi*'s techniques are used to avoid signal distortion and noise problems in DMT systems. Thus, there is a presupposition that a DMT system has been applied to *Gardner* and that certain problems would be worked out using *Cioffi*'s techniques. As discussed herein above, applying DMT techniques in the oil field wireline well-logging environment is not at all obvious. For example, there is no reasonable expectation of success. Therefore, a person of ordinary skill in the art would not jump to looking to *Cioffi* for solutions on how to implement a DMT system in an oil field wireline well-logging application without looking at applicants' invention for a blueprint to find out what techniques would be applicable. Then, having looked at the solution designed and claimed by the applicants, a person may find prior art references that teach those techniques in a different environment, e.g.,

Cioffi. In other words, only through hindsight analysis using applicant's invention would a person arrive at the observation to include, in an oil field implementation of DMT, a training sequence that tunes the system and to perform that step repeatedly during the course of a logging job.

Thus, the rationale offered by the Examiner for combining *Gardner* and *Cioffi* is merely an example of the implicit motivations that motivate progress of science generally. Such an implicit motivation to combine exists "when the 'improvement' is technology-independent and the combination of references results in a product or process that is more desirable, for example because it is stronger, cheaper, cleaner, faster, lighter, smaller, more durable, or more efficient." (*Dystar,* at *33). In such situations, i.e., when the motivation to combine is merely these implicit motivations that drive the desire for technological progress, "the proper question is whether the ordinary artisan possesses knowledge and skills rendering him capable of combining the prior art references." (*Dystar*, at *33). As discussed herein above, and in the declarations of Dr. Clark and Mr. Montgomery, the ordinary artisan would not possess that knowledge. In the various cases cited in *Dystar* in which the patents in question were invalidated as obvious under the aforementioned standard, the modifications were relatively minute in nature. Consider, for example, *Pro-Mold & Tool Co., Inc. v. Great Lakes Plastics, Inc.,* 75 F.2d. 1568 (Fed. Cir. 1996). There the court did not require any evidence of motive. However, the modification of a card holder to only slightly larger than the trading card would easily be within the knowledge and skills of the ordinary artisan. The great leap forward of taking single-carrier oil field well-logging wireline telemetry to DMT modulation is

much different and cannot be said to be within the knowledge and skill of the ordinary artisan.

For at least the foregoing reason, the combination of *Cioffi* with the oil field telemetry prior art, is not supported by the evidence presented by the Examiner. Accordingly, independent claims 9, 14, 21, 28, and 29 are not obvious over any combination based on the combination of *Cioffi* and *Gardner*.

Baird

The Examiner has further relied on *Baird* in combination with *Cioffi* and *Gardner* for the rejections of Claims 2-7,9, and 42-44. Like *Gardner*, *Baird* is an oil field wireline telemetry reference. The reasoning refuting the proposed combination of *Gardner* and *Cioffi* also applies to a combination including *Baird*. Therefore, adding the *Baird* reference does not overcome the problems with the *Gardner-Cioffi* combination. Accordingly, Claim 9 is not obvious over the combination of *Gardner*, *Cioffi*, and *Baird*, whether the references are taken singly, or in any combination.

Gardner, Cioffi, and Isaksson

Claim 12 stands rejected as unpatentable over the combination of *Gardner*, *Cioffi* and *Isaksson*. To provide the motivations for the combinations of *Gardner* with *Cioffi*, and with *Isaksson*, the Examiner provides the same rationale as discussed herein above. For the same reasons given in support of Claims 8 and 9, there is no teaching, suggestion, or motivation to support the proposed combination.

<u>*Matsumoto*</u>

Claims 14, 16, 17, 21-25, 28, 29, 31-35,37-41, 48, 51-53 stand rejected as unpatentable over the combination of *Gardner*, *Cioffi*, and *Matsumoto*. The traversal of the combination of *Gardner* and *Cioffi* presented above is incorporated here by reference.

The Examiner has offered the reason that combining *Gardner* with *Matsumoto* comes from that *Matsumoto* states that DMT modulation can provide high-speed digital communication. (Office Action, Page 17, lines 8-9). As with the reasons given in support of the combination of *Gardner* with *Isaksson*, *Cioffi*, and *Bremer*, this is merely a restatement of the normal quest of technologists to seek to improve the performance of existing systems. It is this drive that moves technology forward. As discussed herein above, there are not many patents that do not claim some advantages such as efficiency, speed, etc. However, just because such an advantage may be achieved by one reference in the context of the operating environment of that reference, does not automatically result in a similar advantage when applied to another reference. As with the other references, an artisan would not have encountered the problems that must be solved in applying DMT technology to oil field wireline telemetry systems without first having attempted to build such systems. Because there is no reasonable expectation of success in doing so, the artisan would not be motivated to attempt that underlying combination. Therefore, the artisan would not arrive at the opportunity to look to *Matsumoto* for solutions to those problems and thus, would not be motivated to combine the teachings of *Matsumoto* with *Gardner*.

<u>*Bae*</u>

Claims 26,45-47,49, and 50 stand rejected as unpatentable over the combination of *Gardner*, *Cioffi*, and *Bae*, and claim 36 stands rejected as unpatentable over the combination of *Gardner*, *Cioffi*, *Bae*, and *Van Kerckhove*. As with the proposed combinations of *Gardner* with *Isaksson*, *Cioffi*, *Bremer*, and *Matsumoto*, with respect to *Bae*, the Examiner merely provides a conclusory statement rather than a reason that the skilled artisan, confronted with the same problem as the inventor would, select the elements from the cited prior art references for combination in the manner claimed. For the combination of *Gardner* and *Cioffi* with *Bae*, the Examiner offered the reasoning that a person would modify the well-logging method with the multi-carrier modulation and training as taught by *Bae* since *Bae* states multi-carrier modulation is the optimum modulation method in which data approximating channel capacity can be transmitted with a minimal error probability (Office Action, page 30, ll. 9-11). This as with the other references merely reiterates an advantage stated in the reference. For the same reasons given above, that is not sufficient to overcome the lack of a reasonable expectation of success, to provide the motivation to combine, and does not provide enough guidance to an ordinary artisan. For the combination with *Van Kerckhove* the Examiner states that the combination of *Gardner*, *Bae*, *Cioffi*, and *Van Kerckhove* is obvious because "*Van Kerckhove* states that his method allows the global capacity of the carriers to be enlarged and maximized the minimum additional noise margins amongst the carriers which renders data transmission less sensitive for noise" (Office Action, Page 33, ll. 8-11). This obviously presupposes a multi-carrier modulation system in an oil field wireline well-

logging environment. Thus, only through hindsight could the combination of *Gardner* with *Van Kerckhove* be contemplated.

For all the foregoing reasons the independent claims are patentable over the cited prior art. The various dependent claims depend, respectively, from the independent claims and incorporate the limitations thereof. The dependent claims provide further unique and non-obvious combinations and are patentable for the reasons given in support of the independent claims and by virtue of such further combinations.

Conclusion of Argument

Appellants have argued hereinabove that the rejections under 35 USC 103(a) are improper and that the claims are patentable over the prior art. Accordingly, Appellants respectfully request reversal of the rejections of Claims 2-9, 12-14, 16, 17, 20-26, and 28-53 and their early allowance.

It is submitted that all the claims now in the application are allowable. Applicants respectfully request reconsideration of the application and claims and its early allowance. The Commissioner is hereby authorized to charge any fees associated with this response that may be required, or credit any overpayment, to Deposit Account 03-0330.

Respectfully Submitted,

/Pehr Jansson/

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8. Claims appendix

PENDING CLAIMS

1. (Cancelled)
2. (Previously presented) The telemetry system of Claim 9, wherein the downhole telemetry cartridge is integrated into one of the at least one downhole tool.
3. (Previously presented) The telemetry system of Claim 9, wherein the downhole telemetry cartridge further comprises a sample clock operating at a sampling rate within the range of 300 kHz to 500 kHz.
4. (Previously presented) The telemetry system of Claim 9, wherein the downhole telemetry cartridge further comprises:

   a cable driver having power optimization logic to adjust total output power of the analog signal to a power level optimized for the wireline cable.
5. (Original) The telemetry system of Claim 4, wherein the cable driver operates from a voltage supply of a range of at least -15 volts and 15 volts.
6. (Original) The telemetry system of Claim 4, wherein the cable driver operates to drive the total output power to the maximum input tolerance power level of the receiver.

7. (Original) The telemetry system of Claim 6, wherein the cable driver operates to drive the total output power without consideration for cross-talk with other signals.

8. (Previously Presented) A telemetry system for transmitting well-logging data from at least one downhole tool to a surface data acquisition system, the at least one down hole tool having a first tool data input/output interface, the telemetry system comprising:

a. a downhole telemetry cartridge connected to the at least one downhole tool via a second tool data input/output interface connected to the first tool data input/output interface, wherein the downhole telemetry cartridge receives a bitstream from the at least one downhole tool over the second input/output interface and comprising:

a transmitter connected to the second tool data input/output interface, and having a logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies to an uphole telemetry unit connected to the downhole telemetry cartridge by a wireline; and

a cable driver having transmission power level control circuitry having logic to control the transmission power to optimize the total transmission power applied to the wireline cable in response to a received adjustment signal transmitted to the downhole telemetry cartridge from the uphole

telemetry unit and wherein the adjustment signal is a function of cable length, cable material, cable temperature, and cable geometry;

b. wherein the uphole telemetry unit is further connected to the surface data acquisition system via an acquisition computer interface and comprising

a receiver connected to the surface data acquisition system and having logic operable to receive the analog signals on the plurality of carrier frequencies, to demodulate the received signals into a bitstream, and to output the bitstream to the acquisition computer via the acquisition computer interface;

overall power setting logic to measure the received signal amplitude and, in response to the measure of the received signal amplitude, to transmit the adjustment signal to the downhole telemetry cartridge; and

logic to cause the overall power setting logic to be executed prior to determining bits-per-carrier and power-level per carrier; and

c. a wireline cable providing an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit, wherein the analog signals are transmitted in an uphole direction on the wireline cable.

9. (previously presented) A telemetry system for transmitting well-logging data from at least one downhole tool to a surface data acquisition system, the at least one down hole tool having a first tool data input/output interface, the telemetry system comprising:

   a. a downhole telemetry cartridge connected to an uphole telemetry unit over a wireline cable that provides an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit;

   b. the downhole telemetry cartridge connected to the at least one downhole tool via a second tool data input/output interface connected to the first tool data input/output interface, wherein the downhole telemetry cartridge receives a bitstream from the at least one downhole tool over the second input/output interface and comprising:

      a transmitter connected to the second tool data input/output interface, and having a logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies and having logic to perform a training sequence including transmitting a known signal on the plurality of carriers, to receive a control signal, and in response to the control signal, to adjust at least one characteristic selected from the set having the members total power, power-per-carrier and bits-per-carrier; and

   c. the uphole telemetry unit connected to the surface data acquisition system via an acquisition computer interface and comprising

a receiver connected to the surface data acquisition system and having logic operable to receive the analog signals on the plurality of carrier frequencies, to demodulate the received signals into a bitstream, and to output the bitstream to the acquisition computer via the acquisition computer interface; and

an uphole transmitter operable to perform a training sequence including to receive the known signal, and in response to receiving the known signal, determining an adjustment selected from the set having the members total power, power-per-carrier and bits-per-carrier, and to transmit control signals from the data acquisition system to the at least one downhole tool, wherein the control signals are transmitted simultaneously on the wireline cable in a second propagation mode that is different from the first propagation mode and at least one of the first and second propagation modes further comprises a pilot tone;

wherein the performance of the training sequence is performed repeatedly during the course of a logging job.

10. (Cancelled)

11. (Cancelled)

12. (Previously Presented) A telemetry system for transmitting well-logging data from at least one downhole tool to a surface data acquisition system, the at least

one down hole tool having a first tool data input/output interface, the telemetry system comprising:

a. a downhole telemetry cartridge connected to the at least one downhole tool via a second tool data input/output interface connected to the first tool data input/output interface, wherein the downhole telemetry cartridge receives a bitstream from the at least one downhole tool over the second input/output interface and comprising:

a transmitter connected to the second tool data input/output interface, and having a logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies; ~~and~~

a cable driver having transmission power control circuitry having logic to independently control the transmission power of each carrier frequency; and

a logic to perform a training sequence including transmitting a known signal on the plurality of carriers, to receive a control signal, and in response to the control signal, to adjust the power-per-carrier;

b. an uphole telemetry unit connected to the surface data acquisition system via an acquisition computer interface and comprising

a receiver connected to the surface data acquisition system and having logic operable to receive the analog signals on the plurality of carrier frequencies, to demodulate the received signals into a

bitstream, and to output the bitstream to the acquisition computer via the acquisition computer interface; and

to perform a training sequence including to receive the known signal, and in response to receiving the known signal, determining an adjustment to the power-per-carrier; and

c. a wireline cable providing an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit, wherein the analog signals are transmitted in an uphole direction on the wireline cable;

wherein the receiver further comprises logic operable to cause the transmission from the receiver to cable driver of a control signal indicative to the power level control circuitry to increase or decrease the transmission power for any carrier frequency; and

wherein the training sequence is performed repeatedly during the course of a logging-job.

13. (Previously presented) A telemetry system for transmitting well-logging data from at least one downhole tool to a surface data acquisition system, the at least one down hole tool having a first tool data input/output interface, the telemetry system comprising:

a. a downhole telemetry cartridge connected to the at least one downhole tool via a second tool data input/output interface connected to the first tool data input/output interface, wherein the downhole telemetry cartridge receives

a bitstream from the at least one downhole tool over the second input/output interface and comprising:

a transmitter connected to the second tool data input/output interface, and having a logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies; and

a cable driver connected having transmission power level control circuitry having logic to control the total transmission power applied to the wireline cable;

b. an uphole telemetry unit connected to the surface data acquisition system via an acquisition computer interface and comprising

a receiver connected to the surface data acquisition system and having logic operable to receive the analog signals on the plurality of carrier frequencies, to demodulate the received signals into a bitstream, and to output the bitstream to the acquisition computer via the acquisition computer interface; and

c. a wireline cable providing an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit, wherein the analog signals are transmitted in an uphole direction on the wireline cable;

wherein the receiver further comprises logic operable to cause the transmission from the receiver to cable driver of a control signal indicative to the transmission power level control circuitry to increase or decrease the total transmission power applied to the wireline cable.

14. (Previously Presented) A telemetry system for transmitting well-logging data from at least one downhole tool to a surface data acquisition system, the at least one down hole tool having a first tool data input/output interface, the telemetry system comprising:

a. a downhole telemetry cartridge connected to the at least one downhole tool via a second tool data input/output interface connected to the first tool data input/output interface, wherein the downhole telemetry cartridge receives a bitstream from the at least one downhole tool over the second input/output interface and comprising:

a transmitter connected to the second tool data input/output interface, and having a logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies;

b. an uphole telemetry unit connected to the surface data acquisition system via an acquisition computer interface and comprising

a receiver connected to the surface data acquisition system and having logic operable to receive the analog signals on the plurality of carrier frequencies, to demodulate the received signals into a bitstream, and to output the bitstream to the acquisition computer via the acquisition computer interface; and

c. a wireline cable providing an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit, wherein the analog signals are transmitted in an uphole direction on the wireline cable;

d. a tone ordering logic operable to divide the bit stream into bit groups such that there is a one-to-one mapping between bit groups and carrier frequencies;

e. a downhole bits-per-carrier table containing a mapping between each bit group and the number of bits allocated to each carrier for each cycle of operation;

f. a constellation encoder connected to receive the bit groups from the tone ordering logic and the bits-per-carrier from the bits-per-carrier table, and operable to encode the bit groups as complex numbers; and

g. a training logic executed repeatedly during the course of a logging job and operable to populate the bits-per-carrier table.

15. (Cancelled)

16. (Previously Presented) The telemetry system of Claim 14 wherein the training logic comprises a downhole training logic and an uphole training logic and wherein the downhole training logic comprises

logic operable to transmit a known signal on each of a plurality of carriers; and

logic operable to receive the number of bits-per-carrier from the uphole telemetry unit; and

the uphole training logic comprises

logic operable to measure the signal-to-noise ratio on the received known signals;

logic operable to determine the number of bits-per-carrier as a function of the signal-to-noise ratio; and

logic operable to cause the transmission of the number of bits-per-carrier to the downhole telemetry cartridge.

17. (Original) The telemetry system of Claim 16 wherein the downhole telemetry cartridge further comprises logic to populate the downhole bit-per-carrier table with the received number of bits-per-carrier; and

wherein the uphole telemetry unit further comprises an uphole bits-per-carrier table and a logic to populate the uphole bits-per-carrier table with the same number of bits-per-carrier.

18. (Cancelled)

19. (Cancelled)

20. (Previously presented) The telemetry system of Claim 8, wherein the downhole telemetry cartridge is constructed from components capable of operation at temperatures above 150 degrees Celsius.

21. (Previously Presented) A method of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, comprising:

executing a training sequence having the steps of:

transmitting a known signal on each of a plurality of carriers from the downhole telemetry cartridge to the uphole telemetry unit;

measuring at the uphole telemetry unit the signal-to-noise ratio on the known signal on each of the plurality of carriers;

using the signal-to-noise ratio measurement to determine the number of bits-per-constellation to use for each carrier; and

populating a bits-per-carrier table with the bits-per-constellation value for each carrier; and

dynamically adjusting the bits-per-carrier table during the course of a logging job by re-transmitting the known signal on a subset of the plurality of carriers, re-measuring at the uphole telemetry unit the signal-to-noise ratio on each of the subset of plurality of carriers, using the re-measured signal-to-noise ratio on each of the subset of plurality of carrier to determine the number of bits-per-constellation to use for each of the subset of the plurality of carriers; and populating the bits-per-carrier table entries for each of the subset of the plurality of carriers with the bits-per-constellation value for each of the subset of the plurality of carriers.

22. (Original) The method of operating a well-logging telemetry system of Claim 21, wherein the step of populating a bits-per-carrier table comprises:

populating a bits-per-carrier table in the uphole telemetry unit and populating a bits-per-carrier table in the downhole telemetry cartridge.

23. (previously presented) The method of operating a well-logging telemetry system of Claim 21, further comprising:

acquiring well-log data from a well-logging tool; and

wherein at least one of the steps of transmitting a known signal on each of a plurality of carriers, measuring the signal-to-noise ratio on the known signal on each of the plurality of carriers, using the signal-to-noise ratio measurement to determine the number of bits-per-constellation to use for each carrier, and populating a bits-per-carrier table with the bits-per-constellation value for each carrier is executed concurrently with the step of acquiring well-log data.

24. (Original) The method of operating a well-logging telemetry system of Claim 21 further comprising:

transmitting a known complex number from the downhole telemetry cartridge to the uphole telemetry unit;

receiving the transmitted complex number at the uphole telemetry unit;

dividing the received complex number by the known complex number thereby obtaining an adjustment parameter; and

using the adjustment parameter for time domain equalization.

25. (Original) The method of operating a well-logging telemetry system of Claim 21, further comprising:

transmitting a known complex number from the downhole telemetry cartridge to the uphole telemetry unit;

receiving the transmitted complex number at the uphole telemetry unit;

dividing the received complex number by the known complex number thereby obtaining an adjustment parameter; and

using the adjustment parameter for frequency domain equalization.

26. (Previously Presented) A method of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, comprising:

during the course of a logging job, repeatedly performing a training sequence including:

transmitting a signal of known power level on each of a plurality of carriers from the downhole telemetry cartridge to the uphole telemetry unit;

measuring the signal amplitude received on each carrier;

comparing the power level received on each carrier to a predetermined maximum power level for each carrier;

based on the comparison of power level, transmitting an indication to adjust the power level on at least one of the carriers from the uphole telemetry unit to the downhole telemetry cartridge;

adjusting the power level of at least one of the carriers based on the indication received.

27. (Cancelled)

28. (Previously Presented) A method of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, comprising:

modulating a bit stream onto a plurality of carrier frequencies;

transmitting the modulated bit stream on a first propagation mode from the downhole telemetry cartridge to the uphole telemetry unit;

operating the uphole telemetry unit to demodulate the received bitstream~~.~~;

during the course of a logging job, repeatedly:

using a training sequence to populate a bits-per-carrier table in the downhole telemetry cartridge and a bits-per-carrier table in the uphole telemetry unit;

wherein the step of modulating the bit stream onto a plurality of carrier frequencies modulates the bit stream for each carrier according to values stored in the downhole bits-per-carrier table for such each carrier; and

wherein the step of demodulating the bit stream demodulates the bit stream from each carrier according to values stored in the uphole bits-per-carrier table.

29. (Previously Presented) A method of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, comprising:

modulating a bit stream onto a plurality of carrier frequencies;

transmitting the modulated bit stream on a first propagation mode from the downhole telemetry cartridge to the uphole telemetry unit;

operating the uphole telemetry unit to demodulate the received bitstream;

during the course of a logging job, repeatedly:

using a training sequence to populate a downhole gain table in the downhole telemetry cartridge and an uphole gain table in the uphole telemetry unit; and

adjusting the gain on each carrier based on values stored in the downhole gain table.

30. (Previously presented) The telemetry system of Claim 8 wherein the wireline cable is a heptacable.

31. (Previously presented) The method of Claim 21, wherein the wireline cable is a heptacable.

32. (Previously presented) The method of Claim 28, wherein the wireline cable is a heptacable.

33. (Previously presented) The method of Claim 14, wherein the downhole telemetry cartridge is integrated into one of the at least one downhole tool.

34. (Previously presented) The system of Claim 14, wherein the wireline cable is a heptacable.

35. (Previously Presented) The telemetry system of Claim 14, wherein the downhole telemetry cartridge is constructed from components capable of operation at temperatures above 150 degrees Celsius.

36. (Previously presented) The method of Claim 26 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, further comprising:

for each carrier that the power level may be increased without exceeding the predetermined maximum power level for the each carrier, determining whether an increase in power level would improve the bits-per-carrier for the each carrier and whether a decrease in power level would degrade the bits-per-carrier for the each carrier;

and wherein in the transmitting step, based on both the comparison of power level and determination of improvement or degradation in bits-per-carrier for at least one of the carriers, the indication to adjust the power level on the at least one of the carriers indicates to increase the power level if an improvement in number of bits-per-carrier may be achieved by a permissible increase in power and wherein the indication to adjust the power level on the at least one of the carriers indicates to lower the power level if there would be no degradation in the number of bits-per –carrier by lowering the power level.

37. (Previously Presented) The method of Claim 21 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, wherein:

the re-transmission of the known signal on a subset of the plurality of carriers is performed periodically.

38. (Previously Presented) The method of Claim 21 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, wherein the re-transmission of the known signal on a subset of the plurality of carriers is performed in response to an observed condition.

39. (Previously Presented) The method of Claim 38 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, wherein the observed condition is selected from the set including the elements deterioration of overall signal-to-noise ratio and deterioration of effective data rate.

40. (Previously Presented) The telemetry system of Claim 8, wherein the transmission of the adjustment signal during the course of a logging job is performed in response to an observed condition.

41. (Previously Presented) The telemetry system of Claim 40 wherein the observed condition is selected from the set including the elements deterioration of overall signal-to-noise ratio and deterioration of effective data rate.

42. (Previously Presented) The telemetry system of Claim 9 wherein the training sequence is performed periodically.

43. (Previously Presented) The telemetry system of Claim 9 the training sequence is performed in response to an observed condition.

44. (Previously Presented) The telemetry system of Claim 43 wherein the observed condition is selected from the set including the elements deterioration of overall signal-to-noise ratio and deterioration of effective data rate.

45. (Previously Presented) The method of Claim 26 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, wherein the training sequence is performed periodically.

46. (Previously Presented) The method of Claim 45 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, wherein the training sequence is performed in response to an observed condition.

47. (Previously Presented) The method of Claim 45 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, wherein the observed condition is selected from the set including the elements deterioration of overall signal-to-noise ratio and deterioration of effective data rate.

48. (Previously Presented) The method of Claim 28 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, wherein:

using a training sequence to populate a bits-per-carrier table in the downhole telemetry cartridge and a bits-per-carrier table in the uphole telemetry unit is performed periodically.

49. (Previously Presented) The method of Claim 26 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, wherein the using a training sequence to populate a bits-per-carrier table in the downhole telemetry cartridge and a bits-per-carrier table in the uphole telemetry unit performed in response to an observed condition.

50. (Previously Presented) The method of Claim 49 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, wherein the observed condition is selected from the set including the elements deterioration of overall signal-to-noise ratio and deterioration of effective data rate.

51. (Previously Presented) The method of Claim 29 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, wherein:

using a training sequence to populate a bits-per-carrier table in the downhole telemetry cartridge and a bits-per-carrier table in the uphole telemetry unit is performed periodically.

52. (Previously Presented) The method of Claim 29 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, wherein the using a training sequence to populate a bits-per-carrier table in the downhole telemetry cartridge and a bits-per-carrier table in the uphole telemetry unit performed in response to an observed condition.

53. (Previously Presented) The method of Claim 52 of operating a well-logging telemetry system having a downhole telemetry cartridge and an uphole telemetry unit connected by a wireline cable, wherein the observed condition is selected from the set including the elements deterioration of overall signal-to-noise ratio and deterioration of effective data rate.

9. Evidence appendix

The declarations of Dr. Lloyd Clark and Mr. Michael Montgomery originally filed with the Office Action Response of December 12, 2005 follow.

APPENDIX 9A: Declaration of Dr. Lloyd D. Clark

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	09/471,659	Confirmation No.	7775
Applicant	:	Clark, Jr. et al.		
Filed	:	12/24/1999		
TC/A.U.	:	2634		
Examiner	:	Odom, Curtis B.		
Docket No.	:	59.0021		

DECLARATION OF DR. LLOYD D. CLARK (37 CFR 1.132)

Dr. Lloyd D. Clark hereby declares that:

I am one of the co-inventors in the above-identified patent application.

I have a Ph. D. degree in Electrical Engineering from the Massachusetts Institute of Technology. I also have Masters and Bachelor of Science degrees in Electrical Engineering from the Massachusetts Institute of Technology.

From 1990 through 2003 I was employed by Schlumberger Technology Corporation, and worked in the field of well-logging technology, and more specifically, worked in the field of well-logging wireline telemetry for at least 10 years. Since 2004 I have been employed by Ticom Geomatics, Austin, Texas, USA and have been working in the field of Wireless Geolocation.

I have acquired extensive expertise in Discrete Multi-Tone communication through my employment.

I am the inventor on two issued patents in the field of well-logging wireline telemetry (U.S. Patent Number 5,483,232, granted 1996 and U.S. Patent

Number 5,736,936, granted 1998) and I am the author of two published peer-reviewed papers in the field of well-logging wireline telemetry.

I am familiar with the above-referenced patent application, and have reviewed the prior art cited by the Examiner therein, as well as the reasons for rejection of the claims in that application stated by the Examiner. I believe that the claimed invention is not obvious for the following reasons.

In regard to the general statements made by the Examiner in the *Response to Arguments* section

In regard to the general statements made by the Examiner in the *Response to Arguments* section of the Office Action (Page 2), I note the following statements:

> "DMT does not recognize the environment to which it is implemented (in other words, the environment does not affect the process of DMT modulation)."

That statement is incorrect in view of the state of the digital telemetry art as of December 24, 1999. The physical environment is one of the major challenges to digital telemetry in wireline well-logging applications. High temperatures, such as those encountered when exploring petroleum wells drilled deep into the earth's crust, are known to affect the attenuation of signals over the transmission medium. Furthermore, equipment used in wireline well-logging has to take into account the mechanical requirements of the wireline cable, notably the requirement to support the weight of the cable itself and the tools attached thereto. Therefore, the wireline cable may not be the ideal medium for a particular type of

digital data communication. Additionally, the design requirements for a wireline telemetry system for well-logging require cable lengths of at least 30,000 feet as petroleum wells are often at least that long.

A person of ordinary skill in the art of digital communication would not expect success to come from applying known DMT techniques in wireline telemetry systems for well-logging. In 1998 Schlumberger performed a series of tests using DMT-based ADSL modems purchased from Aware, Inc. I was the principal investigator carrying out these experiments. These tests investigated the performance of DMT-based ADSL modems when applied to the well-logging environment. These experiments demonstrated that DMT-based ADSL modems could not establish a communications link when used over a 30,000-foot length of well-logging wireline cable. Any person trying to adapt DMT techniques from ADSL would encounter similar difficulties.

<u>In regard to Claims 21, 22, 24, 25, 28, 29, 31, and 32 as unpatentable over Matsumoto and In regard to Claim 23 as unpatentable over Matsumoto in view of Rasmussen</u>

In regard to the rejection of Claims 21, 22, 24, 25, 28, 29, 31, and 32 as unpatentable over Matsumoto (U.S. Pat. No. 6,522,731, hereinafter Matsumoto), I note the following statements made by the Examiner:

> "It would have been obvious to one of ordinary skill in the art at the time the invention was made that since it is well known that DMT modulation can be used in the presence of cables, the method of

Matsumoto could have been implemented in a well-logging environment." (Office Action, Page 4, lines 6-9).

In regard to the rejection of Claim 23 as unpatentable over Mastsumoto in view of Rasmussen U.S. Patent No. 4,490,788), I note the following statements made by the Examiner:

"Rasmussen discloses acquiring well-log data from a well-logging tool while concurrently receiving transmissions signals. Rasmussen discloses implementing a large number of processing systems which allow multiple functions to be performed simultaneously and the measurement of well-logging systems to be executed concurrently with the processing of these measurements. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the method of Matsumoto could have been implemented to execute concurrently with step of acquiring well-logging data in a well-logging environment as taught by Rasmussen. By executing these steps simultaneously in a well-logging environment, the processing speed in the well-logging device would be increased."

These statements are incorrect, in view of the data communications art as of December 24, 1999. One skilled in the art would not have made the modifications to Matsumoto that would yield the claimed invention, for the following reasons:

The claimed invention recites "operating a well-logging telemetry system ... transmitting a known signal on each of a plurality of carriers from the downhole telemetry cartridge to the uphole telemetry unit ... using [a] signal-to-noise ratio measurement to determine the number of bits-per-constellation to use for each

carrier [based on a signal-to-noise ratio measurement at the uphole telemetry unit]; and populating a bits-per-carrier table with the bits-per-constellation value for each carrier."

Matsumoto describes DMT as implemented for ADSL, wherein the band of 30 kHz to 320 kHz represents the up multicarrier wave for ADSL communication and the band of 30 kHz to about 1.1 MHz represents the down multicarrier wave for ADSL communication. This technique only works on telephone cables up to lengths of approximately 18,000 feet, and fails completely on well-logging cables that are 30,000 feet long.

Matsumoto deals with solving problems that may occur in telephony art. The invention deals with the transmission of data on a plurality of carriers on a wireline used in well-logging telemetry systems. Matsumoto does not teach the use of the techniques described therein in a well-logging telemetry system. Thus, at least one modification to Matsumoto required to yield the claimed invention would be the introduction of a downhole telemetry cartridge. Considering that Matsumoto teaches a solution to a problem encountered in the telephony art, a person of ordinary skill in the art would not be motivated to modify Matsumoto in such a fashion.

Furthermore, Matsumoto solves problems that are associated with using a telephone line simultaneously for data communication and audio communication. To modify Matsumoto to operate in the well-logging environment, i.e., transmitting a known signal on each of a plurality of carriers from a downhole telemetry cartridge, would render Matsumoto unsatisfactory for its intended purpose of being useful for simultaneous audio and data communication.

Matsumoto's invention solves the problem of quickly adapting to an on-hook/off-hook telephone line but does not provide the slightest suggestion as to how to make the system work on a cable length of 30,000 feet. Persons skilled in the art of ADSL would be aware of the limitations of ADSL techniques and would not expect these techniques to be successfully applied to well-logging wireline telemetry.

As previously stated above, Matsumoto deals with solving problems that one may encounter in the telephony art andoil well operations are very different from those encountered in telephony. The cables are longer than the maximum station-to-station distances used in telephony, the operating temperatures are vastly higher, the pressures are also much higher, the cables are not of the same design as that found in telephony, etc. Because these differences are very significant in the operation of data communications equipment and methodologies, one would not have expected to have success in applying Matsumoto's telephony-related invention for use in wireline well-logging operations.

<u>In regard to Claim 26 as unpatentable over Bae and in regard to Claim 36 as being unpatentable over Bae in view of Van Kerchove</u>

In regard to the rejection of Claim 26 as unpatentable over Bae et al. (U.S. Pat. No. 5,832,387, hereinafter Bae), I note the following statements made by the Examiner:

"However, Bae et al. does disclose the current method can be implemented into any transmission system adopting a multicarrier method (column 1, lines 7-13) including those systems in which a wireline cable is used as the

propagation medium (column 2, lines 17-39). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that since it is well known that multicarrier modulation can be used in the presence of cables, the method of Bae et al. could have been implemented in a well-logging environment." Office Action, Page 9, lines 1-7.

In regard to the rejection of Claim 36 as unpatentable over Bae et al. in view of Van Kerchove (U.S. Patent No. 5,812,599), I note the following statements made by the Examiner:

"It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the multicarrier transmission method of Bae et al. with the teachings of Van Kerchove since Van Kerchove states that his method allows the global capacity of the carriers to be enlarged and maximized the minimum additional noise margins amongst the carriers which renders data transmission less sensitive for noise." These statements are incorrect, in view of the data communications art as of December 24, 1999. One skilled in the art would not have made the modifications to Bae that would yield the claimed invention, for the following reasons:

Claim 26 recites, for example, "transmitting a signal of known power level on each of a plurality of carriers from the downhole telemetry cartridge to the uphole telemetry unit" wherein the preamble indicates that these form part of a well-logging telemetry system.

From the premise that a technique can be used in the presence of cables it does not follow that the same technique can be used in all uses of cables. As

with Matsumoto, Bae describes DMT as implemented for ADSL. Bae does not teach or suggest adapting the teachings of Bae in a well-logging environment. As noted above ADSL techniques do not readily work in a well-logging environment. A person of ordinary skill in the art would at the time of the invention be aware of the limitations of ADSL and would not be motivated to adapt ADSL prior art references, such as Bae, to work in a well-logging environment.

Furthermore, Bae states that "the ADSL system is new technology in which a conventional copper wired line can be used without modification and the signal can be transmitted to subscribers within a range of 3-4 km without any repeater." Bae, Col. 2, lines 21-24. 3-4 km corresponds to a range of approximately 10,000 – 13,000 feet. Petroleum oil wells are often drilled to a length exceeding 30,000 feet. Thus, a person of ordinary skill would realize that such systems do not meet the requirements faced by the petroleum exploration industry and, therefore, would not be motivated to modify Bae to be used in well-logging telemetry.

Van Kerchove, like Matsumoto and Bae, describes DMT as implemented for ADSL. While Van Kerchove mentions that the techniques described therein can be used in other DMT applications, e.g., Orthogonal Frequency Division Mutliplexing (OFMD) (Van Kerchove, Col. 15, lines 39-42), no teaching or suggestion of how to extend DMT to such domains, or to the well-logging environment is disclosed in Van Kerchove. As with Bae and Matsumoto, a person skilled in the art would know of the limitations of ADSL technology and would therefore not be motivated to apply Van Kerchove to wireline telemetry systems for well-logging.

<u>In regard to Claims 8, 12, 13, 20 and 30 as unpatentable over Gardner in view of Isaksson and In regard to Claims 2-7 and 9 as unpatentable over Gardner in view of Isaksson and further in view of Baird</u>

In regard to the rejection of Claim 8, 12, 13, 20 and 30 as unpatentable over Gardner et al. (U.S. Pat. No. 5,832,387, hereinafter Gardner [note that the spelling as used by the Examiner, Gardener, is incorrect]) in view of Isaksson , I note the following statements made by the Examiner:

"It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the transmitter and receiver of Gardener et al. with the transmitter and receiver logic of Isaksson et al. because DMT modulation divides the frequency band into discrete subchannels, which allows transmitter to avoid the noisy channels and maximize the bit rate using the best subchannels. It would also have been obvious to one of ordinary skill in the art at the time the invention was made to modify the transmitter and receiver of Gardener et al. with the transmission power control logic of Isaksson et al. to control transmission power level of each carrier at the transmitter by measuring signal-to-noise ratio at the receiver to produce a more reliable transmission signal from the receiver when transmission power is increased and to decrease power consumption when transmission power is decreased."

In regard to the rejection of Claim 2-7, and 9 as unpatentable over Gardner in view of Isaksson and further in view of Baird, I note the following statements made by the Examiner:

"It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the teachings of Baird et al. into the device of Gardener et al. and Isaksson et al. in order to avoid using separate cables to transmit each signal which reduces the cost and increases the reliability of the device."

These statements are incorrect in view of the state of the art of wireline telemetry for well-logging applications as of December 24, 1999 for the following reasons:

First, one skilled in the art would not have applied Isaksson's transmitter and receiver logic to Gardner because Gardner is a single-carrier communications system for well-logging cables. Gardner does not suggest using multi-carrier communications systems. Therefore, the person of ordinary skill in the art would not look to techniques found in multi-carrier systems like Isaksson's for the purpose of enhancing Gardner.

Second, Isaksson describes a DMT system as implemented in a multi-carrier system for the installed copper network. This system provides transmission over copper cables up to a length of 1300 meters. Baird specifically discloses that the cable therein is typically five or more miles (i.e., 26,400 feet or approximately 8,000 meters) (Baird, Col. 5, lines 1-2), which is consistent with oil-field use. Isaksson's system would fail completely if applied to cables of 30,000 feet (approximately 10,000 meters, i.e., an order of magnitude longer than those used by Isaksson) or even 26,400 feet (~8,000 meters). Therefore, a person of ordinary skill familiar with Isaksson would not seek to extend its use to the well-logging realm, e.g., by combining the teaching of Isaksson with Baird or Gardner.

Third, the Examiner's statement is illogical from the perspective of Gardner in that Gardner does not deal with multi-carrier communication. Therefore, it would be impossible to "avoid the noisy channels and maximize the bit-rate using the best subchannels" because Gardner has but one channel and thus no subchannels.

Fourth, Isaksson's system for controlling the power level of each carrier presumes that there is more than one carrier. As noted, Gardner is a single-carrier system. Therefore, it would not be useful to modify Garner with Isaksson's system for controlling power level on each carrier when there is only a single carrier, as it would be unnecessary to add logic which would allow manipulation of power on multiple carriers). Baird also is a single-carrier system with respect to each propagation mode. Therefore, it would also not be useful to modify Baird with Isaksson's system for controlling power level on each carrier.

Fifth, Baird deals explicitly with the multiple transmission modes available on a wireline heptacable, specifically for providing power on a logging cable. For example, Baird states that "[i]n a preferred embodiment, cable 20 is a seven-conductor logging cable such as that which is obtainable from various companies [sources omitted]" (Baird, Col. 4, lines 33-35). As I have stated hereinabove, Isaksson describes a system DMT as implemented in a multi-carrier system for the installed copper network. The installed copper network does not use seven-conductor cables. It would therefore not be logical to apply Baird's power delivery system. Logging tools require relatively large amounts of power. Therefore, power-delivery is one of the many challenges in well-logging applications. However, the power-delivery of power used to power logging tools should not be confused with transmission power for data communication, such as that discussed by Isaksson.

Baird explicitly states that it provides "a system and method for ... providing up to 1800 watts to downhole equipment over existing logging cables" (Abstract). That kind of power-delivery is not one of the purposes of the installed copper network for telephony discussed in Isaksson. Furthermore, the installed copper-network of Isaksson is not suitable for high-power delivery. Placing 1800 watts on such a network would certainly not be possible.

<u>In regard to Claims 14, 15, 33-35 as unpatentable over Gardner in view of Matsumoto and In regard to Claims 16 and 17 as unpatentable over Gardner in view of Matsumoto and in further view of Tzannes</u>

In regard to the rejection of Claim 8, 12, 13, 20 and 30 as unpatentable over Gardner in view of Matsumoto, I note the following statements made by the Examiner:

DMT modulation causes transmission of the bitstream as analog signals on a plurality of carrier frequencies. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the transmitter and receiver of Gardener et al. with the transmitter and receiver logic of Matsumoto because DMT modulation divides the frequency band into discrete subchannels, which allows transmitter to avoid noisy channels and maximize the bit rate using the best subchannels."

In regard to the rejection of Claim 16 and 17 as unpatentable over Gardner in view of Matsumoto and further in view of Tzannes, I note the following statements made by the Examiner:

"It would have been obvious to one skilled in the art at the time the invention was made to modify the apparatus of Gardener et al. and Matsumoto with the teachings of Tzannes et al. since Tzannes et al. states that in order for the receiver to correctly interpret the received data, both the first device and the second device must use the same bits-per-carrier table."

These statements are incorrect in view of the state of the art of wireline telemetry as of December 24, 1999 for the following reasons:

First, Matsumoto describes DMT as implemented for ADSL, wherein the band of 30 kHz to 320 kHz represents the up multicarrier wave for ADSL communication and the band of 30 kHz to about 1.1 MHz represents the down multicarrier wave for ADSL communication. This technique only works on telephone cables up to lengths of approximately 18,000 feet, and fails completely on well-logging cables that are 30,000 feet long. A person of ordinary skill in the art would therefore not look to be able to use the techniques used in Matsumoto with the well-logging telemetry system of Gardner.

Second, one skilled in the art would not have applied Isaksson's transmitter and receiver logic to Gardner because Gardner is a single-carrier communications system for well-logging cables. Gardner does not suggest using multi-carrier communications systems. Therefore, the person of ordinary skill in the art would not look to techniques found in multi-carrier systems like Matsumoto for the purpose of enhancing Gardner.

Third, the Examiner's statement makes no sense from the perspective of Gardner in that Gardner does not deal with multi-carrier communication.

Therefore, it would make no sense to "avoid the noisy channels and maximize the bit-rate using the best subchannels" because Gardner has but one channel and thus no subchannels. It would be impossible to select from that which does not exist.

Furthermore, I note the Examiner's statement that:

"The utilization of multiple carriers allows more data to be transmitted with an increase in transmission rate. Therefore, it would have also been obvious to one of ordinary skill in the art to take advantage of DMT modulation rather than a single carrier modulation method."

This is incorrect in view of the state of the art of wireline telemetry as of December 24, 1999 for the following reasons:

At that time (December 24, 1999) there was no prior art example of using DMT in a well-logging telemetry system. The use of multiple carriers, while increasing the transmission rate, has associated therewith many limitations. It would be incorrect to presume that DMT may be readily applied over a particular transmission medium. For example, as I have noted herein above, the techniques of Matsumoto and Bae would fail if applied on cables of great length regularly encountered in well-logging operations. The challenges of applying DMT-based ADSL techniques, e.g., Matsumoto or Bae, in the well-logging environment was further demonstrated by the experiments described hereinabove. Therefore, a person of ordinary skill in the art would not readily apply DMT modulation in such an environment.

Because of the difficulties in deploying DMT modulation successfully, a person of ordinary skill in the art would not expect success to come from applying known DMT techniques in wireline well-logging telemetry systems.

I further declare that all statements made herein of my own knowledge are true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,

Dr. Lloyd D. Clark

Dr. Lloyd D. Clark

December 9, 2005

Date

APPENDIX 9B: Declaration of Mr. Michael Montgomery

DECLARATION OF MICHAEL A. MONTGOMERY (37 CFR 1.132)

Michael A. Montgomery hereby declares that:

I am an expert in the field of Wireline Communications.

I have a Masters degree in Computer Engineering and Computer Science from the Stanford University, graduating at the top of my class with a 3.97/4.00 average. I also have a Bachelor of Science degree in Electrical Engineering from the University of Tennessee, graduating at the top of my class with an average of 4.00/4.00.

From 1983 through 1994 I worked in the field of well-logging technology, and more specifically, worked in the field of well-logging wireline telemetry full time or as a consultant during that time.

I am the inventor on seven issued patents in the field of well-logging wireline telemetry:

US 6,175,599 METHOD AND APPARATUS FOR TRANSMITTING AND RECEIVING DIGITAL DATA OVER A BANDPASS CHANNEL (2001)

US 5,838,727 METHOD AND APPARATUS FOR TRANSMITTING AND RECEIVING DIGITAL DATA OVER A BANDPASS CHANNEL (1998)

US 5,331,318 COMMUNICATION PROTOCOL FOR DIGITAL TELEMETRY SYSTEM [CLOCK SYNCHRONIZATION] (1994)

US 5,253,271 METHOD AND APPARATUS FOR QUADRATURE AMPLITUDE MODULATION OF DIGITAL DATA USING A FINITE STATE MACHINE (1993)

US 5,191,326 COMMUNICATION PROTOCOL FOR DIGITAL TELEMETRY SYSTEM [RETRANSMISSION PROTOCOL] (1993)

US 4,992,790 DIGITAL PHASE LOCKED LOOP BIPHASE DEMODULATING METHOD AND APPARATUS (1991)

US 4,868,569 BIPHASE DIGITAL LOOK-AHEAD DEMODULATING METHOD AND APPARATUS (1990)

I am the author of over a dozen published peer-reviewed papers in the field of well-logging wireline telemetry, include best paper awards in 1988 for "Evolution Of The Digital Telemetry System Protocol" and in 1990 for "Finite State Machine Implementation of a Quadrature Amplitude Modulator".

I am familiar with the above-referenced patent application, and have reviewed the prior art cited by the Examiner therein, as well as the reasons for rejection of the claims in that application stated by the Examiner. I believe that the claimed invention is not obvious for the following reasons.

Some of the most difficult aspects of well-logging wireline communications stem from the harsh environment for such operations. The conditions in a well-bore raise challenges not found in most other communications

environments. Thus, novel techniques must be used to adapt methods that might be suitable for a less demanding environment to the rigors of the well-bore environment.

One challenge is dealing with the high temperature and high shock encountered in the borehole environment and the resulting effects on electronic circuitry. Borehole equipment is often exposed to shocks well over 10G, which can often break loose surface mounted components unless special precautions are taken, or through-hole versions of the parts are used instead. Borehole temperatures are often quite high. Borehole electronics is usually designed to withstand temperatures of 175 or 200 degrees Celsius, with special cooling environments for even high temperatures. Most commercial components are only rated for 70 or 85 degrees Celsius; even military grade components are only rated to 125 degrees Celsius. Components must be specially designed or selected for higher temperatures to be suitable for borehole electronics. This limits the components available. So a technique that called for a particular kind of component might need major rework in an environment where that kind of component will not work.

In addition, certain silicon characteristics that could be ignored at lower temperatures become dominant at 175 C, such as leakage currents. For high temperature environments, standard design techniques often fail because they do not take into account such effects that are negligible at lower temperatures. For example, balanced circuits must often be used to suppress leakage currents. Again, substantial innovation is often required to use even what might be considered conventional techniques to adapt them to a borehole environment.

Another challenge is dealing with a radically changing communication channel not found in most other systems. As the tool is lowered into the borehole, the tool and cable heat up. The change in cable characteristic as a cable slowly heats from 20 C to 200 C radically alters the transmission channel characteristics over time. In addition, tool power of hundreds of volts and over one thousand watts is transmitted on the same wires used for the channel, adding noise to the channel as tool power requirements vary. Therefore, borehole communications requires compensation and channel adaptation techniques rarely found in other environments. A DSL telephone system might have to deal with two versions of the transmission channel: one version when the voice channel is in use, and another version when the voice channel is not in use. This situation encountered in telephony is trivial compared to the wireline channel, where the channel characteristics are continuously variable over a far wider range of variance. The vast majority of communication techniques are simply not suited for dealing with such variance.

One of the major innovations of the current invention is the novel and highly optimized manner in which the communications channel is subdivided and adapted as the various subchannels undergo often major changes in transmission characteristics over time, necessitating the shift of transmission load between subchannels to reoptimize based on ever changing subchannel characteristics.

The art cited provides no clue as to whether the components or design techniques would even work in the hostile borehole environment, or with a radically changing communications channel, or what techniques might be required to adapt to such a hostile environment. Much of the art cited is like using prior art for bathroom tiles to infer that it is obvious to one of ordinary skill in the art to design such tiles to

protect the space shuttle from reentry. This would clearly be absurd. The same could be said for taking a telephone system design intended to operate at room temperature or commonly encountered surface temperatures on 22 gauge copper twisted wire, and assuming that such techniques could be used in the borehole environment. Just connect 400 volts (as one typically encounters in well-logging wireline-telemetry) to standard home telephone wires and to observer the folly of this expectation.

For these reasons, a person skilled in the art would not be motivated to modify the prior art references from the ADSL domain, e.g., Matsumoto or Bae, for use in well-logging wireline telemetry. Furthermore, for those same reasons, a person skilled in the art would not be motivated to combine the references dealing with telephony based digital communications technology, e.g., Matsumoto, Bae, Isaksson, Van Kerchove, and Tzannes with the references from the well-logging wireline telemetry field, e.g., Rasmussen, Gardner, and Baird.

For the reasons given above, a person skilled in the art would not expect success from combining telephone system technologies in well-logging wireline telemetry, e.g., Matsumoto, Bae, Isaksson, Van Kerchove, and Tzannes with the references from the well-logging wireline telemetry field, e.g., Rasmussen, Gardner, and Baird.

Furthermore, I declare that I concur with the Declaration of Dr. Lloyd Clark filed concurrently herewith including Dr.Clarks declarations with respect to the specific prior art references cited against the claims of the present patent application.

In summary, prior art must be applicable by someone of ordinary skill of the art. With such a radically different environment for borehole electronics, I defy

anyone of ordinary skill in the art to apply the cited references to a borehole environment. An inventive step is most definitely required, and in some cases, as an *expert* in the field, it is not clear to me that the techniques cited in the art could even be adapted to the borehole environment by an expert in the field.

I further declare that all statements made herein of my own knowledge are true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully,

Michael A. Montgomery

Michael Montgomery

12/12/05

Date

10. Related proceedings appendix

Not applicable.